What is claimed is:

1. A metal plating bath comprising metal salts and an additive consumption inhibiting compound having a formula:

$$R^1\text{-}X\text{-}R^2$$

where X is $-S(O)_n-$, $-S(O)_n-S(O)_p-$, $-S(O)_n-S(O)_p-S(O)_q-$, $-S(O)_n-S(O)_p-S(O)_q-S(O)_u-$, $-S(O)_n-S(O)_p-S(O)_q-S(O)_u-S(O)_v-$, $-S(O)_n-S(O)_p-S(O)_q-S(O)_u-S(O)_v-S(O)_w-$, $-(S(O)_z)_m-(CH_2)_y-(S(O)_{z'})_{m'}-$, or

$-SO_2-S-(CH_2)_y-S-SO_2-$, where n, p, q, u, v, w, z and z' are each independently an integer from 0 to 2, and m and m' are independently an integer from 1 to 6 and y is an integer of from 2 to 4; R^1 and R^2 are each independently halogen; -OH; $(C_1\text{-}C_{20})$ linear, branched, or cyclic alkyl; $(C_2\text{-}C_{20})$ linear, branched, or cyclic alkenyl; or $(C_2\text{-}C_{20})$ linear, or branched alkynyl; or $(C_1\text{-}C_{20})$ alkyl-$O(C_2\text{-}C_3O)_tR^5$, $(C_1\text{-}C_{12})$ alkyphenyl-$O(C_2\text{-}C_3O)_tR^5$, or –phenyl-$O(C_2\text{-}C_3O)_tR^5$, where t is an integer of from 1-500 and R^5 is hydrogen, $(C_1\text{-}C_4)$ alkyl or phenyl; the alkyl, alkenyl or alkynyl are unsubstituted, or substituted; or

X is a heteroatom selected from S, O, N, or N substituted with $(C_1\text{-}C_6)$ alkyl or a tosyl group, and R^1 and R^2 may be taken together along with the atoms to which they are attached to form a 5 to 18 membered heterocyclic ring that may be unsubstituted or substituted, saturated or unsaturated comprising 1 to 8 heteroatoms, the heterocyclic ring optionally containing one or more carbonyls; and the metal salts are salts of metals selected from the group consisting of copper, gold, silver, platinum, palladium, cobalt, chromium, cadmium, bismuth, indium, lead, tin, rhodium, iridium, ruthenium, zinc, and mixtures thereof.

2. The metal plating bath of claim 1, wherein the alkyl, alkenyl, or alkynyl groups are substituted with one or more of halogen, aryl, silyl, -SH, -CN, -SCN, -C=NS, $Si(OH)_3$, $-NO_2$, $P(R)_2$, -OH, -COOH, $-CO(C_1\text{-}C_{12})$ alkyl, $-COO(C_1\text{-}C_{12})$ alkyl, silane, $-NR^3R^4$, $-PO_3M$, or $-SO_3M$ with the proviso that when $-SO_3M$ or $-PO_3M$ is a substituent X contains more than two sulfur atoms in a chain, M is hydrogen, or an alkali metal, R is hydrogen or halogen, and R^3 and R^4 are independently hydrogen, halogen, aryl, or $(C_1\text{-}C_{12})$ linear or branched alkyl.

3. The metal plating bath of claim 1, wherein the 5 to 18 membered heterocyclic ring is substituted on one or more carbons of the ring with –COOH, -OH, $(C_1\text{-}C_6)$ alkyl, hydroxy $(C_1\text{-}C_6)$ alkyl, or carboxyl $(C_1\text{-}C_6)$ alkyl.

4. The metal plating bath of claim 1, wherein the additive consumption inhibiting compound comprises methyl sulfoxide, methyl sulfone, tetramethylene sulfoxide, thioglycolic acid, 2 (5H) thiophenone, 1,4-dithiane, trans-1,2-dithiane, tetrahydrothiophene-3-one, 3-thiophenemethanol, 1,3,5-trithiane, 3-thiophenacetic acid, thiotetronic acid, crown ethers, crown thioethers, tetrapyrids, dipropyltrisulfide, bis(3-triethoxy silyl) propyl tetrasulfide, dimethyl tetrasulfide, methyl methanethiosulfate, carboxyethyl methane, p-tolyl disulfoxide, p-tolyldisulfone, bis(phenylsulfonyl)sulfide, 4(chlorosulfonyl) benzoic acid, thioctic acid, phenyl vinyl sulfone, 4-hydroxy-benzene sulfonic acid, isopropylsulfonyl chloride, 1-propanesulfonyl chloride, or mixtures thereof.

5. The metal plating bath of claim 4, wherein the crown thioethers comprise 1,5,9,13-tetrathiacyclohexadecane, 1,5,9,13-tetrathiacyclo-hexadecane-3,11-diol, 1,4,7,10-tetrathiacyclodecane, or mixtures thereof.

6. The metal plating bath of claim 4, wherein the crown ethers comprise 12-crown-4, 15-crown-5, 18-crown-6, (+)-(18-crown-6)-2,3,11,12-tetracarboxylic acid, or mixtures thereof.

7. The metal plating bath of claim 1, wherein heterocyclic nitrogen compounds comprise 1,4,7,10,13,16-hexamethyl-1,4,7,13,16-hexaazacyclooctadecane, 1,4,7,10-tetra-p-tosyl-1,4,7,10-tetraazacyclododecane, 1,4,10,13-tetraoxa-7,16-diazacyclooctadecane, or mixtures thereof.

8. The metal plating bath of claim 1, wherein the additive consumption inhibiting compound comprises from about 0.001 g/L to about 100 g/L of the bath.

9. The metal plating bath of claim 1, further comprising additives comprising brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, or suppressors.

10. The metal plating bath of claim 9, wherein the brighteners comprise compounds having the formulas: HO_3S-R^{11}-SH; HO_3S-R^{11}-S-S-R^{11}-SO_3H, where R^{11} is C_1-C_6 alky or an aryl group; or HOS_3-Ar-S-S-Ar-SO_3H, where Ar is phenyl or naphthyl, the alky and aryl groups may be unsubstituted or substituted with an alkyl group, halo or alkoxy group.

11. The metal plating bath of claim 9, wherein the brighteners comprise 3-mercapto-propylsulfonic acid sodium salt, 2-mercapto-ethanesulfonic acid sodium salt, bissulfopropyl disulfide, or mixtures thereof.

12. The metal plating bath of claim 9, wherein the brightener comprises 3-mercapto-propylsulfonic acid sodium salt, 2-mercapto-ethanesulfonic acid sodium salt, bissulfpropyl

disulfide, N,N-dimethyldithiocarbamic acid (3-sulfopropyl) ester sodium salt, (O-ethyldithiocarbonato)-S-(3-sulfopropyl)-ester potassium salt, 3-[(amino-iminoethyl)-thio]-1-propanesulfonic acid, 3-(2-benzthiazolylthio)-1-propanesulfonic acid sodium salt or mixtures thereof.

13. The plating bath of claim 9, wherein the levelers comprise alkylated polyalkyleneimines, organo sulfo sulfones, dyes of the phenazine class, phenazine azo dyes, or mixtures thereof.

14. The plating bath of claim 9, wherein the brighteners comprise 3-(benzthiazoyl-2-thio)-propylsulfonic acid sodium salt, 3-mercaptopropane-1-sulfonic acid sodium salt, ethylenedithiodipropylsulfonic acid sodium salt, bis-(p-sulfopehnyl)-disulfide disodium salt, bis-(ω-sulfobutyl)-disulfide disodium salt, bis-(ω-sulfohydroxypropyl)-disulfide disodium salt, bis-(ω-sulfopropyl)-disulfide disodium salt, bis-(ω-sulfopropyl)-sulfide disodium salt, methyl-(ω-sulfopropyl) sodium salt, methyl-(ω-sulfopropyl)-trisulfide disodium salt, O-ethyl-dithiocarbonic acid-S-(ω-sulfopropyl)-ester, potassium salt thioglycolic acid, thiophosphoric acid-O-ethyl-bis-(ω-sulfopropyl)-ester disodium salt, thiophosphoric acid-tri(ω-sulfopropyl)-ester trisodium salt, or mixtures thereof.

15. The plating bath of claim 9, wherein the suppressors comprise carboxymethylcellulose, nonyphenolpolyglycol ether, octandiolbis-(polyalkylene glycolether), octanolpolyalkylene glycolether, oleic acidpolyglycol ester, polyethylenepropylene glycol, polyethylene glycol, polyethylene glycoldimethylether, polyoxypropylene glycol, polypropylene glycol, polyvinylalcohol, stearic acidpolyglycol ester, stearyl alcoholpolyglycol ether, or mixtures thererof.

16. The metal plating bath of claim 1, wherein the pH of the bath ranges from 0 to about 8.0.

17. A copper metal plating bath comprising a copper salt, and an additive consumption inhibiting compound having a formula:

$$R^1\text{-}X\text{-}R^2$$

where X is $-S(O)_n-$, $-S(O)_n-S(O)_p-$, $-S(O)_n-S(O)_p-S(O)_q-$, $-S(O)_n-S(O)_p-S(O)_q-S(O)_u-$, $-S(O)_n-S(O)_p-S(O)_q-S(O)_u-S(O)_v-$, $-S(O)_n-S(O)_p-S(O)_q-S(O)_u-S(O)_v-S(O)_w-$, $-(S(O)_z)_m-(CH_2)_y-(SO_{z'})_{m'}-$, or $-SO_2-S-(CH_2)_y-S-SO_2-$, where n, p, q, u, v, w, z and z' are each independently an integer from 0 to 2, and m and m' are independently an integer from 1 to 6 and y is an integer of from 2 to 4; R^1 and R^2 are independently halogen, -OH, (C_1-C_{20}) linear, branched, or cyclic alkyl, (C_2-C_{20}) linear, branched, or cyclic alkenyl, (C_2-C_{20}) linear or branched alkynyl; or (C_1-C_{20}) alkyl-$O(C_2-C_3O)_tR^5$,

$(C_1\text{-}C_{12})$ alkylphenyl-$O(C_2\text{-}C_3O)_tR^5$, or –phenyl-$O(C_2\text{-}C_3O)_tR^5$, where t is an integer of from 1-500 and R^5 is hydrogen, $(C_1\text{-}C_4)$ alkyl or phenyl; the alkyl, alkenyl, and alkynyl groups are unsubstituted or substituted; or

X is a heteroatom selected from S, O, N, or N substituted with $(C_1\text{-}C_6)$ alkyl or a tosyl group, and R^1 and R^2 may be taken together along with the atoms to which they are attached to form a 5 to 18 membered heterocyclic ring, unsubstituted or substituted, saturated or unsaturated comprising 1 to 8 heteroatoms, the heterocyclic ring optionally contains one or more carbonyls.

18. The copper metal plating bath of claim 17, wherein the alkyl, alkenyl, or alkynyl groups are substituted with one or more of halogen, aryl, silyl, -SH, -CN, -SCN, C=NS, $Si(OH)_3$, $-NO_2$, $P(R)_2$, -OH, -COOH, $-CO(C_1\text{-}C_{12})$ alkyl, $-COO(C_1\text{-}C_{12})$ alkyl, NR^3R^4, silane, $-PO_3M$ or $-SO_3M$ with the proviso that when $-SO_3M$ or $-PO_3M$ is a substituent X contains more than two sulfur atoms in a chain, M is hydrogen, or an alkali metal, R is hydrogen or halogen, and R^3 and R^4 are independently hydrogen, halogen, aryl or $(C_1\text{-}C_{12})$ linear or branched alkyl.

19. The copper metal electroplating bath of claim 17, wherein the 5 to 18 membered heterocyclic ring is substituted on one or more carbons of the ring with –COOH, -OH, $(C_1\text{-}C_6)$ alkyl, hydroxy $(C_1\text{-}C_6)$ alkyl, or carboxyl $(C_1\text{-}C_6)$ alkyl.

20. The copper metal electroplating bath of claim 17, wherein the additive consumption inhibiting compound comprises methyl sulfoxide, methyl sulfone, tetramethylene sulfoxide, thioglycolic acid, 2 (5H) thiophenone, 1,4-dithiane, trans-1,2-dithiane, tetrahydrothiophene-3-one, 3-thiophenemethanol, 1,3,5-trithiane, 3-thiopheneacetic acid, thiotetronic acid, crown ethers, crown thioethers, tetrapyrids, dipropyltrisulfide, bis(3-triethoxy silyl propyltetrasulfide, dimethyl tetrasulfide, methyl methanethiosulfate, (2-sulfonatoethyl) methane, p-tolyldisulfoxide, p-tolyldisulfone, bis(phenylsulfonyl)sulfide, 4-(chlorosulfonyl) benzoic acid, isopropyl sulfonyl chloride, 1-propane sulfonyl chloride, thioctic acid, 4-hydroxy-benzene sulfonic acid, phenyl vinyl sulfone, or mixtures thereof.

21. The copper metal electroplating bath of claim 20, wherein the crown ethers comprise 12-crown-4, 15-crown-5, 18-crown-6, (+)-(18-crown-6)-2,3,11,12-tetracarboxylic acid, or mixtures thereof.

22. The copper metal electroplating bath of claim 20, wherein the tetrapyrids comprise 1,5,9,13-tetrathiacyclohexadecane, 1,5,13-tetrathiacyclo-hexadecane-3,11-diol, 1,5,9,13-tetracyclohexadecane, or mixtures thereof.

23. The copper metal electroplating bath of claim 17, wherein heterocyclic nitrogen compounds comprise 1,4,7,10,13,16-hexamethyl-1,4,7,10,13,16-hexaazacyclooctadecane, 1,4,7,10-tetra-p-tosyl-1,4,7,10-tetraazacyclododecane, 1,4,10,13-tetraoxa-7,16-diazacyclooctadecane, or mixtures thereof.

24. The copper metal electroplating bath of claim 17, wherein the additive consumption inhibiting compounds comprise from about 0.001 g/L to about 100 g/L of the bath.

25. The copper metal electroplating bath of claim 17, wherein the copper metal salts comprise copper halides, copper sulfate, copper alkane sulfonate, copper alkanol sulfonate, or mixtures thereof.

26. The copper metal electroplating bath of claim 17, wherein the bath has a pH of from 0 to about 8.0.

27. The copper metal plating bath of claim 17, further comprising additives comprising brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, suppressors or mixtures thereof.

28. The copper metal plating bath of claim 27, wherein the brighteners comprise compounds having the structural formula: $HO_3S\text{-}R^{11}\text{-}SH$; $HO_3S\text{-}R^{11}\text{-}S\text{-}S\text{-}R^{11}\text{-}SO_3H$, where R^{11} is $C_1\text{-}C_6$ alkyl group or an aryl group; or $HO_3S\text{-}Ar\text{-}S\text{-}S\text{-}Ar\text{-}SO_3H$, where Ar is phenyl or naphthal; the alkyl and aryl groups may be alkyl groups, halo or alkoxy.

29. The copper metal plating bath of claim 27, wherein the levelers comprise alkylated polyalkyleneimines, organic sulfo sulfonates, dyes of the phenazine class and phenazine azo dyes of mixtures thereof.

30. A method of plating a metal on a substrate comprising: contacting the substrate with a metal plating bath; and applying sufficient current density to the plating bath to deposit the metal on the substrate; the plating bath comprises a metal salt from a metal selected from the group consisting of copper, gold, silver, palladium, platinum, cobalt, cadmium, chromium, bismuth, indium, lead, tin, rhodium, iridium, ruthenium, zinc, and mixtures thereof; and an additive consumption inhibiting compound having the formula:

$$R^1\text{-}X\text{-}R^2$$

where X is $-S(O)_n\text{-}$, $-S(O)_n\text{-}S(O)_p\text{-}$, $-S(O)_n\text{-}S(O)_p\text{-}S(O)_q\text{-}$, $-S(O)_n\text{-}S(O)_p\text{-}S(O)_q\text{-}S(O)_u\text{-}$, $-S(O)_n\text{-}S(O)_p\text{-}S(O)_q\text{-}S(O)_u\text{-}S(O)_v\text{-}$, $-S(O)_n\text{-}S(O)_p\text{-}S(O)_q\text{-}S(O)_u\text{-}S(O)_v\text{-}S(O)_w\text{-}$, $-(S(O)_z)_m\text{-}(CH_2)_y\text{-}(S(O)_{z'})_{m'}\text{-}$, or

$-SO_2-S-(CH_2)_y-S-SO_2-$, where n, p, q, u, v, w, z and z' are each independently an integer from 0 to 2, and m and m' are independently an integer from 1 to 6 and y is an integer of from 2 to 4; and R^1 and R^2 are independently halogen, -OH, (C_1-C_{20}) linear, branched, or cyclic alkyl, (C_2-C_{20}) linear, branched, or cyclic alkenyl, (C_2-C_{20}) linear, or branched alkynyl; (C_1-C_{20}) alkyl-O(C_2-$C_3O)_tR^5$, (C_1-C_{12}) alkylphenyl-O(C_2-$C_3O)_tR^5$, or –phenyl-O(C_2-$C_3O)_tR^5$, where t is an integer of from 1-500 and R^5 is hydrogen, (C_1-C_4) alkyl, or phenyl; the alky, alkenyl and alkynyl groups may be unsubstituted or substituted; or

X is a heteroatom selected from S, O, N, or N substituted with (C_1-C_6) alkyl or a tosyl group, and R^1 and R^2 may be taken together along with the atoms to which they are attached to form a 5 to 18 membered heterocyclic ring unsubstituted or substituted, saturated or unsaturated comprising 1 to 8 heteroatoms, the heterocyclic ring optionally contains one or more carbonyls.

31. The metal plating bath of claim 30, wherein the alkyl, alkenyl, alkynyl or aryl are substituted with one or more of halogen, aryl, silyl, silane, -SH, -CN, -SCN, -C=NS, $-Si(OH)_3$, $-NO_2$, $-P(R)_2$, -OH, -COOH, -COO(C_1-C_{12}) alkyl, -CO(C_1-C_{12}) alky, NR^3R^4, $-PO_3M$, or $-SO_3M$ with the proviso that when $-SO_3M$ or $-PO_3M$ is a substituent X is more than two sulfur atoms in a chain, M is hydrogen, or an alkali metal, R is a hydrogen or a halogen, and R^3 and R^4 are independently hydrogen, halogen, aryl or (C_1-C_{12}) linear or branched alkyl.

32. The metal plating bath of claim 30, wherein the 5 to 18 membered heterocyclic ring is substituted on one or more carbons of the ring with –COOH, -OH, (C_1-C_6) alkyl, hydroxy (C_1-C_6) alkyl, or carboxyl (C_1-C_6) alkyl.

33. The method of claim 30, wherein the additive consumption inhibiting compound comprises methyl sulfoxide, methyl sulfone, tetratmethylene sulfoxide, thioglycolic acid, 2 (5H) thiophenone, 1,4-dithiane, trans-1,2-dithiane, tetrahydrothiophene-3-one, 3-thiophenemethanol, 1,3,5-trithiane, 3-thiophenacetic acid, thiotetronic acid, crown ethers, crown thioethers, tetrapyrids, phenyl vinyl sulfone, thioctic acid, 4-hydroxy-benzene sulfonic acid, or mixtures thereof.

34. The method of claim 33, wherein the crown ethers comprise 12-crown-4, 15-crown-5, 18-crown-6, or (+)-(18-crown-6)-2,3,11,12-tetracarboxylic acid.

35. The method of claim 33, wherein the tetrapyrids comprise 1,5,9,13-tetrathiacyclohexadecane, 1,5,9,13-tetrathiacyclo-hexadecane-3,11-diol, or 1,4,7,10-tetrathiacyclodecane.

36. The method of claim 30, wherein the hetero-cyclic nitrogen compound comprises 1,4,7,10,13,16-hexamethyl-1,4,7,10,13,16-hexaazacyclooctadecane, 1,4,7,10-tetra-p-tosyl-1,4,7,10-tetraazacyclododecane or 1,4,10,13-tetraoxa-7,16-diazacyclooctadecane.

37. The method of claim 30, wherein the additive consumption inhibiting compound comprises from about 0.001 g/L to about 100 g/L of the bath.

38. The method of claim 30, further comprising brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, suppressors or mixtures thereof.

39. The method of claim 38, wherein the brighteners comprise compounds of the formula: HO_3S-R^{11}-SH; HO_3S-R^{11}-S-S-R^{11}-SO_3H, where R^{11} is C_1-C_6 or an aryl group; and HO_3S-Ar-S-S-Ar-SO_3H, where Ar is phenyl or naphthyl; and the alkyl and aryl groups may be unsubstituted or substituted with an alkyl group, a halo or an alkoxy.

40. The method of claim 30, wherein the substrate is a printed wiring board, an integrated circuit, an electrical contact surface, a connector, an electrolytic foil, a silicon wafer, a semi-conductor, a lead frame, an optoelectronic component, a solder bump on a silicon wafer, a decorative article, a sanitary appliance, and the like.

41. A method for plating copper metal on a substrate comprising: contacting the substrate with a metal plating bath; and applying sufficient current density to the plating bath to deposit the metal on the substrate; the copper metal plating bath comprises a copper salt and an additive inhibiting compound having the formula:

$$R^1\text{-}X\text{-}R^2$$

where X is $-S(O)_n$-, $-S(O)_n$-$S(O)_p$-, $-S(O)_n$-$S(O)_p$-$S(O)_q$-, $-S(O)_n$-$S(O)_p$-$S(O)_q$-$S(O)_u$-, $-S(O)_n$-$S(O)_p$-$S(O)_q$-$S(O)_u$-$S(O)_v$-, $-S(O)_n$-$S(O)_p$-$S(O)_u$-$S(O)_v$-$S(O)_w$-, $-(S(O)_z)_m$-$(CH_2)_y$-$(S(O)_{z'})_{m'}$-, or $-SO_2$-S-$(CH_2)_y$-S-SO_2-, where n, p, q, u, v, w, z and z' are each independently an integer from 0 to 2, and m and m' are independently an integer of from 1 to 6, and y is an integer of from 2 to 4; R^1 and R^2 are each independently halogen, -OH, (C_1-C_{20}) linear, branched or cyclic alkyl, (C_2-C_{20}) linear, branched or cyclic alkenyl, (C_2-C_{20}) linear, or branched alkynyl; or (C_1-C_{20}) alkyl-O(C_2-$C_3O)_tR^5$, (C_1-C_{12}) alkylphenyl-O(C_2-$C_3O)_tR^5$, or –phenyl-O(C_2-$C_3O)_tR^5$, where t is an integer of from 1-500 and R^5 is hydrogen, (C_1-C_4) alkyl or phenyl; the alkyl, alkenyl, alkynyl may be unsubstituted or substituted; or

X is a heteroatom selected from S, O, N, or N substituted with (C_1-C_6) alkyl or a tosyl group, and R^1 and R^2 may be taken together along with the atoms to which they are attached to form a 5 to

18 membered heterocyclic ring unsubstituted or substituted, saturated or unsaturated comprising 1 to 8 heteroatoms, the heterocyclic ring optionally contains one or more carbonyls.

42. The method of claim 41, wherein the alkyl, alkenyl, or alkynyl may be substituted with one or more of halogen, aryl, silyl, silane, -SH, -CN, -SCN, -C=NS, $-Si(OH)_3$, $-NO_2$, $-P(R)_2$, -OH, COOH, $-COO(C_1-C_{12})$ alkyl, $-CO(C_1-C_{12})$ alkyl, NR^3R^4, $-PO_3M$ or $-SO_3M$ with the proviso that when $-SO_3M$ or $-PO_3M$ is a substituent X is more than two sulfur atoms in a chain, M is hydrogen, or an alkali metal, R is hydrogen or halogen, and R^3 and R^4 are independently hydrogen, halogen, aryl, or (C_1-C_{12}) linear or branched alkyl.

43. The method of claim 41, wherein the 5 to 18 membered heterocyclic ring is substituted on one or more carbons of the ring with –COOH, -OH, (C_1-C_6) alkyl, hydroxy (C_1-C_6) alky, or carboxyl (C_1-C_6) alkyl.

44. The method of claim 41, wherein the additive consumption inhibiting compound comprises methyl sulfoxide, methyl sulfone, tetramethylene sulfoxide, thioglycolic acid, 2 (5H) thiophenone, 1,4-dithiane, trans-1,2-dithiane, tetrhydrothiophenone-3-one, 3-thiophenemethanol, 1,3,5-trithiane, 3-thiophenacetic acid, thiotetronic acid, crown ethers, crown thioethers, tetrapyrids, phenyl vinyl sulfone, thioctic acid, 4-hydroxy-benzene sulfonic acid, or mixtures thereof.

45. The method of claim 44, wherein the crown ethers comprise 12-crown-4, 15-crown-5, 18-crown-6, or (+)-(18-crown-6)-2,3,11,12-tetracarboxylic acid.

46. The method of claim 44, wherein the tetrapyrids comprise 1,5,9,13-tetrathiacyclo-hexadecane-3,11-diol, or 1,4,7,10-tetrathiacyclodecane.

47. The method of claim 41, wherein the heterocyclic nitrogen compounds comprise 1,4,7,13,16-hexamethyl-1,4,7,10,13,16-hexaazacyclooctadecane, 1,4,7,10-tetra-p-tosyl-1,4,7,10-tetraazacyclododecane, or 1,4,10,13-tetraoxa-7,16-diazacyclooctadecane.

48. The method of claim 41, wherein the additive consumption inhibiting compound comprises from about 0.001 g/L to about 100 g/L of the bath.

49. The method of claim 41, further comprising brighteners, levelers, hardeners, wetting agents, malleability modifiers, ductility modifiers, deposition modifiers, suppressors or mixtures thereof.

50. The method of claim 49, wherein the brighteners comprise compounds of the formula: $HO_3S-R^{11}-SH$; $HO_3S-R^{11}-S-S-R^{11}-SO_3H$, where R^{11} is C_1-C_6 alkyl or an aryl group; or

HO_3S-Ar-S-S-Ar-SO_3H, where Ar is phenyl or naphthyl; the C_1-C_6 alkyl and aryl group may be unsubstituted or substituted with an alkyl group, halo or alkoxy group.

51. The method of claim 41, wherein the substrate comprises a printed wiring board, an integrated circuit, an electrical contact surface, a connector, an electrolytic foil, a silicon wafer, a semi-conductor, a lead frame, an optoelectronic component, a solder bump on a wafer, a decorative article, a sanitary appliance, and the like.

52. An apparatus for electroplating a substrate comprising an electrical power source electrically connected with an insoluble anode and a cathode such that an electrical current can pass through the insoluble anode and the cathode, the insoluble anode and the cathode are in contact with a metal plating bath comprising a salt of a metal selected from the group consisting of copper, gold, silver, palladium, platinum, cobalt, cadmium, chromium, bismuth, indium, rhodium, iridium, ruthenium, zinc or mixtures thereof, and an additive consumption inhibiting compound, the additive consumption inhibiting compound having a formula:

$$R^1\text{-}X\text{-}R^2$$

where X is $-S(O)_n$-, -$S(O)_n$-$S(O)_p$-, -$S(O)_n$-$S(O)_p$-$S(O)_q$-, -$S(O)_n$-$S(O)_p$-$S(O)_q$-$S(O)_u$-, -$S(O)_n$-$S(O)_p$-$S(O)_q$-$S(O)_u$-$S(O)_v$-, $-(S(O)_z)_m$-$(CH_2)_y$-$(S(O)_{z'})_{m'}$-, or -SO_2-S-$(CH_2)_y$-S-SO_2-, where n, p, q, u, v, w, z and z' are each independently an integer from 0 to 2, and m and m' are each independently an integer from 1 to 6 and y is an integer of from 2 to 4; R^1 and R^2 each are independently –OH, halogen, (C_1-C_{20}) linear, branched, cyclic alkyl, (C_2-C_{20}) linear, branched, or cyclic alkenyl, (C_2-C_{20}) linear, or branched alkynyl; (C_1-C_{20}) alkyl-$O(C_2$-$C_3O)_tR^5$, (C_1-C_{12}) alkylphenyl-$O(C_2$-$C_3O)_tR^5$, or –phenyl-$O(C_2$-$C_3O)_tR^5$, where t is an integer of from 1-500 and R^5 is hydrogen, (C_1-C_4)alkyl or phenyl; the alkyl, alkenyl and alkynyl groups may be unsubstituted or substituted; or

X is a heteroatom selected from S, O, N, or N substituted with (C_1-C_6) alkyl or tosyl group, and R^1 and R^2 may be taken together along with the atoms to which they are attached to form a 5 to 18 membered heterocyclic ring unsubstituted or substituted, saturated or unsaturated comprising 1 to 8 heteroatoms, the heterocyclic ring optionally contains one or more carbonyls.

53. The apparatus of claim 52, wherein the alkyl, alkenyl, alkynyl, and aryl groups are substituted with one or more of halogen, aryl, silyl, silane, -SH, -CN, -SCN, -C=NS, -$Si(OH)_3$, NO_2, -$P(R)_2$, -OH, -COOH, -$CO(C_1$-$C_{12})$, -$COO(C_1$-$C_{12})$ alkyl, NR^3R^4, -PO_3M, or $-SO_3M$ with the proviso that when $-SO_3M$ or $-PO_3M$ is a substituent X is more than two sulfur atoms in a

chain, M is hydrogen, or an alkali metal, R is hydrogen or halogen, and R^3 and R^4 are independently hydrogen, halogen, aryl or (C_1-C_{12}) linear or branched alkyl.

54. The apparatus of claim 52, wherein the 5 to 18 membered heterocyclic ring is substituted on one or more of the carbons of the ring with –COOH, -OH, (C_1-C_6) alkyl, hydroxy (C_1-C_6) alky, or carboxyl (C_1-C_6) alkyl.

55. The apparatus of claim 52, wherein the additive consumption inhibiting compound comprises from about 0.001 g/L to about 100.0 g/L of the bath.

56. The apparatus of claim 52, wherein the metal plating bath further comprises brighteners, levelers, hardeners, wetting agents malleability modifiers, ductility modifiers, deposition modifiers or suppressors.

57. The apparatus of claim 52, wherein a pH of the metal plating bath is from 0 to about 8.0.

58. The apparatus of claim 52, wherein the metal salt comprises copper halides, copper sulfate, copper alkane sulfonate, copper alkanol sulfonate, or mixtures thereof.

59. The apparatus of claim 52, wherein the insoluble anode comprises metals of cobalt, nickel, ruthenium, rhodium, palladium, iridium, or platinum.

60. The apparatus of claim 59, wherein the insoluble anode further comprises metals of titanium, zirconium, hafnium, vanadium, niobium, or tantalum.

61. The apparatus of claim 60, wherein the insoluble anode further comprises metals of beryllium, calcium, strontium, barium, scandium, yttrium, lanthanum, or rare earth elements.

62. The apparatus of claim 52, wherein the insoluble anode comprises iridium dioxide.

63. The apparatus of claim 52, wherein the cathode comprises a wiring board, an integrated circuit, an electrical contact surface, a connector, an electrolytic foil, a silicon wafer, a semi-conductor, a lead frame, an optoelectronic component, a solder bump, a decorative article, a sanitary appliance and the like.

64. The apparatus of claim 52, wherein the insoluble anode and the cathode have a current density of from about 1 to about 1000 amps/ft^2.